Ta chien lu is a typical Tibetan town, with its "curved roofs, gilded pinnacles surrounded by a mediæval wall," and its extensive and gaudy "lamasarai" Walled in by gigantic mountains as it is, Ta chien lu has become a most important economic and strategical centre. Since the Koko Nor trade route has been abandoned, all the trade of Tibet (skins, wool, gold and musk) passes into China this way; and it is by this route that the soft, irruptive Chinese tide made its way, by sheer force of patient persistence, into the strongholds of the hardy Tibetan and reduced Tibet to a dependency. Mr. Little hardly appreciates the chicken-hearted nature of Tibetan morale, so much is it disguised by the stalwart, muscular personality of the mountain-bred nomad. The Tibetan submits to slipshod Chinese domination without a murmur.

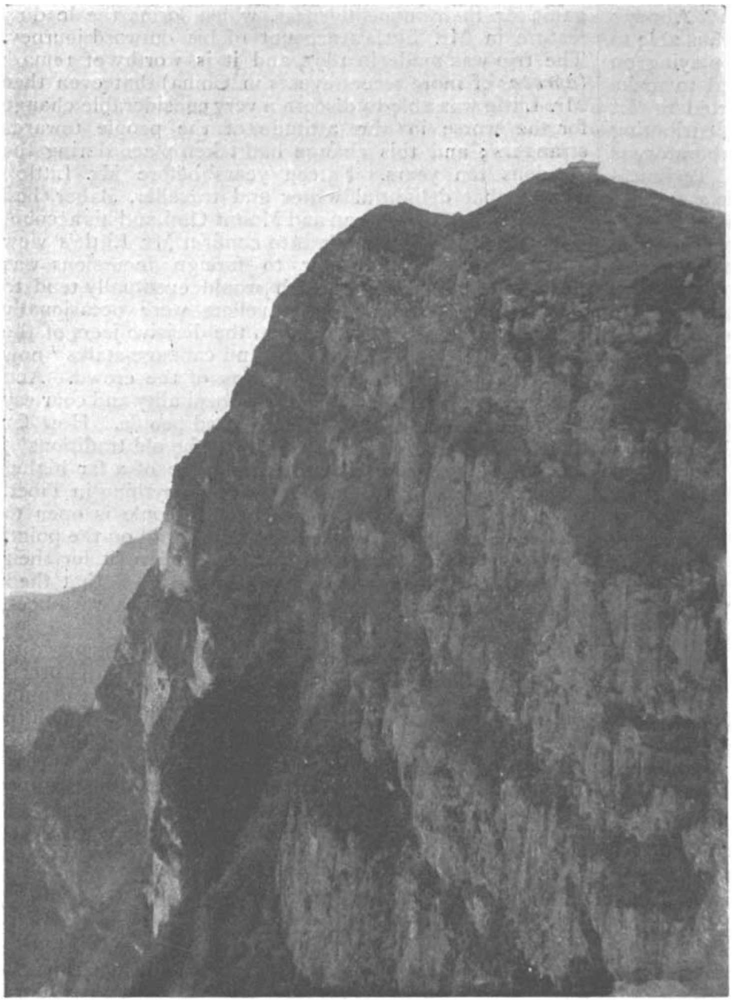

FIG. 1.—Summit of Mount Omi, with Temples.

Ta chien lu is the great western tea mart, and the trade (along with pawnbroking, according to other observers) is altogether in the hands of the Lamas. The manufacture of brick tea for the Tibetan market is faithfully described. It is enough to say that Tibetans like the tea so manufactured, and will "use no other." The bridge at Luting over the Tung, which alone makes the route practicable, is a work of Chinese enterprise which has now lasted for 200 years without repair. It is an iron suspension bridge, and for details of its construction (which are really worth attentive study) the reader cannot do better than refer to Mr. Little's book.

The return journey down the Yangtse, through the rapids and reaches of its upper course, is a feature in the story which will be more or less familiar to many recent travellers. The book is interesting throughout, and not the least value of it is the vista which it opens up of future economic possibilities in that teeming eastern region, the Yangtse basin.

PROF. JOSEF VON FODOR.

BY the death of Prof. von Fodor, of Budapest, the eastern part of Europe has lost its great teacher of hygiene, and the world one of its most diligent investigators in the domain of public health. His investigations had chiefly to do with the soil, subsoil water and ground air, and his authority on these matters is universally recognised. His chief treatises were on air, water and soil in connection with diseases, to which a happy reference was made by the public orator at Cambridge when von Fodor was awarded the hon. LL.D. degree on the occasion of the London meeting of the International Congress of Hygiene and Demography in 1891, as follows:—

"Quis nescit urbem florentissimam, quod Hungariæ caput est, nomine bilingui nuncupatam, fluminis Danubii in utraque ripa esse positam. Quis non inde nobis feliciter advectum esse gaudet salutis publicæ professorem insignem, virum titulis plurimis cumulatum, qui etiam de Angliæ salubritate opus egregium conscripsit? Idem, velut alter Hippocrates, de aëre, aquis et locis præclare disseruit. Olim Hippocrates ipse corona aurea Atheniensium in theatro donatus est; nos Hippocratis æmulum illustrem laurea nostra qualicunque in hoc templo honoris libenter ornamus.

Duco ad vos bacteriologiæ cultorem accerrimum, Iosephum de Fodor"

Of this degree von Fodor was justly proud, as he showed by wearing the scarlet gown to which it entitled him on important occasions.

He was a sincere, unaffected and amiable man, whose premature death has been a very severe shock to his many friends and admirers.

W. H. C.

NOTES.

A MEETING of the local branch of the general committee for the purpose of founding a memorial to the late Prof. Fitzgerald was held on March 28 in Trinity College, Dublin. Dr. Tarleton presided. The meeting was attended by representatives of the leading societies and clubs of the University. It was resolved that the proposed memorial would most appropriately take the form of an endowment of research in physical science by advanced students. In this manner the work of the late professor would best be carried forward. Letters were read from many distinguished scientific men expressing sympathy with the movement. An executive committee was elected and empowered to take the requisite steps to afford the many friends and admirers of the late Prof. Fitzgerald an opportunity of forwarding the object in view.

M. SABATIER, professor of chemistry in the University of Toulouse, has been elected a member of the section of chemistry of the Paris Academy of Sciences, in succession to M. Haller, who has been elected a member of the Academy. Prof. Davidson, of the University of California, has been elected a correspondant of the section of geography and navigation.

THE American Academy of Arts and Sciences elected the following foreign honorary members at the last meeting:—Prof. J. H. Poincaré, Paris (Mathematics and Astronomy); Prof. Henrich Muller-Breslau, Berlin (Technology and Engineering); Prof. H. Kronecker, Bern (Zoology and Physiology); Prof. R. Koch, Berlin (Medicine and Surgery); Sir T. Lauder Brunton, London (Medicine and Surgery); Prof. A. V. Dicey, Oxford (Philosophy and Jurisprudence); Mr. W. E. Hearn, Melbourne (Philosophy and Jurisprudence); and Dr. Henry Jackson, Cambridge (Philosophy and Archæology).

THE ninth James Forrest lecture of the Institution of Civil Engineers will be delivered by Dr. Frank Clowes on April 25. The subject will be "Chemistry in its Relations to Engineering."

THE *Frankfurter Zeitung* announces the death, at Waiblingen, Wurtemberg, from malaria, of Dr. Schlichter, the well-known African traveller and geographer.

THE death is announced of Mr. W. Hodgson, who for more than half a century devoted his leisure to the collection of facts relating to the flora of his native county, Cumberland. He was the author of a "Flora of Cumberland," which was published about two years ago.

THE *Athenaeum* announces the death of Dr. Franz Melde, professor of astronomy and physics and director of the mathematical and physical institute of the University of Marburg, on March 17, at the age of sixty-nine. Dr. Melde distinguished himself in every branch of experimental physics, notably in his special subject acoustics, and his book on "Zeitbestimmungen" proved a valuable contribution to astronomy.

REUTER'S Agency is informed that the whaler *America*, which has been bought by Mr. Evelyn B. Baldwin, the American explorer, for his forthcoming journey to the North Pole, will sail from Dundee on June 18, by which date Mr. Baldwin expects to arrive from the United States. The *America* will proceed direct to Norway, where she will join the two other ships which are to form part of the expedition, and, after taking on board stores and equipment, will proceed for the North.

THE ship which has been built for the German Antarctic Expedition was launched at Kiel on Tuesday. The Berlin correspondent of the *Times* states that among those who were present at the ceremony were Count Posadowsky, the Secretary of State for Home Affairs, Prof. von Drygalski, who will have charge of the expedition, and representatives of the Foreign Office, the Admiralty, and the local authorities. The vessel was christened the *Gauss* by Prof. Baron von Richthofen, who the course of a short speech said that the German nation would follow the fortunes of the expedition with hope and with anxiety. The name *Gauss* was selected by order of the Emperor in honour of the Göttingen professor, the late Karl Friedrich Gauss, who did much to stimulate Antarctic research. A telegram was received from Count von Bulow cordially wishing the expedition every success.

THE following are among the lecture arrangements at the Royal Institution, after Easter:—Dr. Allan Macfadyen, six lectures on cellular physiology, with special reference to the enzymes and ferments; Mr. Roger Fry, two lectures on naturalism in Italian painting; Prof. Dewar, three lectures on the chemistry of carbon; Prof. W. M. Flinders Petrie, three lectures on the rise of civilisation in Egypt; Prof. J. B. Farmer, two lectures on the biological characters of epiphytic plants; Mr. J. Y. Buchanan, three lectures on climate: its causes and effects. The Friday evening meetings will be resumed on April 19, when a discourse will be delivered by Prof. J. J. Thomson on the existence of bodies smaller than atoms. Succeeding discourses will probably be given by Dr. Hans Gadow, Mr. Charles Mercier, Prof. J. Chunder Bose, Mr. R. T. Glazebrook, Mr. A. Henry Savage Landor, and other gentlemen.

THE annual meeting of the Iron and Steel Institute will be held in London on May 8 and 9. As a tribute of respect to the memory of her late Majesty the Queen, it has been decided that the usual annual dinner shall not be held this year. At the opening meeting on May 8 the retiring president, Sir William Roberts-Austen, K.C.B., will induct into the chair the president-elect, Mr. William Whitwell. The Bessemer Gold Medal for 1901 will be presented to Mr. J. E. Stead. Among the papers that are expected to be submitted to the meeting are the following:—On the properties of steel castings, by Prof. J. O. Arnold; on the physical properties of steel, by Mr. J. A. Brinell; on the heat of formation of carbides and silicides of iron, by Mr. E. D. Campbell; on the use of hydraulic power in the manufacture of iron and steel, by Mr. R. M. Daelen (Düsseldorf); on dust in blast-furnace gas, by Mr. A. Greiner; on the economical significance of high silicon in pig iron for the acid steel processes, by Mr. Axel Sahlin; on crystals of carbo-silicide of manganese and iron from a blast-furnace burden, by Mr. J. E. Stead; on the effect of copper in steel rails and plates, by Messrs. J. E. Stead and John Evans (Middlesbrough); on the measurement of Young's modulus for iron rods by tension and by bending, by Mr. H. E. Wimperis. The autumn meeting of the Institute will be held in Glasgow on September 3 and following days, simultaneously with the holding of the International Engineering Congress, of section V. (Iron and Steel), of which the Iron and Steel Institute has undertaken to take charge.

THE annual general meeting of the Chemical Society was held on Thursday, March 28. Dr. T. E. Thorpe, who occupied the chair, referred to the death of her late Majesty Queen Victoria, and said he was proud to think that the Chemical Society, in so far as it had ministered to the progress of chemistry, contributed in some measure to the lustre of a reign so pre-eminently associated with the development and spread of science in this country, and with the extension of those arts which rest upon chemistry. During the past year the publications of the Society were exceptionally full and valuable. The volume of *Transactions* for 1900 contained no less than four memorial lectures, giving an account of the life-work of Victor Meyer, Bunsen, Friedel and Nilson. The council had determined to issue those memorial lectures which had appeared up to the end of 1900 in a separate form. Acting upon the result of the voting of the Fellows on the question of the day and hour of meeting, the council had decided that the suggested change should be provisionally tried during the coming session. The ordinary meetings of next session would therefore be held on the first and third Wednesdays of the month, at 5.30 p.m. A reference was made to the movement for a uniform system of atomic weights, and it was announced that a committee of the Society had decided to recommend (1) that $O = 16$ be taken as the basis of calculation of atomic weights; (2) that in assigning a number as the atomic weight of any element only so many figures should be employed that the last may be regarded as accurately known to one unit in that figure. Prof. J. Emerson Reynolds was elected president of the Society, in succession to Dr. Thorpe. At the annual dinner of the Society, held on Wednesday, March 27, toasts were proposed and acknowledged by Dr. Thorpe (who presided), Prof. Tilden, the Lord Chancellor, Sir Herbert Maxwell, Lord Kelvin, Prof. Dewar, Mr. A. B. Kempe, Prof. S. P. Thompson, Prof. Emerson Reynolds, Sir W. S. Church, Sir Francis Mowatt and Sir Henry Roscoe.

At the annual meeting of the Institution of Naval Architects, on March 27–29, the Earl of Glasgow was elected president. The next meeting of the Institution will be held at Glasgow, on June 25–28. An international engineering congress will be held in Glasgow early in September, and the Institution has undertaken the management of the section relating to naval architecture and marine engineering. The Earl of Glasgow delivered an address, in which he reviewed the progress of shipping during the past year, commenting upon the announcement recently made by the First Lord of the Admiralty, that, for the first time in our history, submarine boats have been ordered for experimental purposes. At the close of the president's address, Prof. G. H. Bryan, F.R.S., was presented with the gold medal of the Institution for his paper on the action of bilge keels. Prof. J. H. Biles then read a paper on naval construction in the United States. Among other matters he noted some rather important details common to the larger classes of American ships. Cofferdams filled with obturating material, which is expected to expand when in contact with the water, are fitted very generally at the sides of the ship. This material is the pith of the corn stock, and has been experimented upon very fully by the navy department, with the result that designs have been prepared with the intention of adopting it generally. It is evident that if the corn stock material swells when in contact with water sufficiently to fill up holes made by shot, it will have an important effect upon the margin of stability and probably of buoyancy of a ship in action. Another paper read before the Institution was on an instrument for measuring the rolling of ships, by Mr. A. Mallock, who, after pointing out the difficulty of accurately measuring the angle of roll of a ship, described an indicator which would give a very accurate measure of the rolls in all circumstances.

Important papers were read at the meeting referred to in the foregoing note. Herr Otto Schlick described experiments to determine the cause of small vibrations in the *Deutschland* during her trial trip in June last. The conclusion arrived at from his experiments is that one blade of the propeller has a greater resistance in turning than the other blades, or that the opposite blade has a correspondingly less resistance. Such greater resistance of the one blade is in most cases probably to be attributed to its greater pitch. The least deviation in the pitch, which cannot be proved by ordinary instruments, appears to cause perceptible vertical vibrations, and therefore the greatest care should be taken in the manufacture of propellers, not only for the sake of doing away with vibration, but also to save power and prevent breakage of the blades. Mr. C. H. Wingfield discussed the view that the thrust of a submerged propeller is greatest on those parts of the blade which are most deeply immersed, and gave reasons for an opposite conclusion. Papers on the mathematics of engine-balancing were read by Mr. J. Macfarlane Gray and Prof. W. E. Dalby. Captain W. Hovgaard, of the Danish Navy, dealt with the motion of submarine boats in a vertical plane. He pointed out that for such submarine boats as are now generally constructed, of from 100 to 200 tons displacement, and with our present means of underwater propulsion, a speed above twelve knots must be considered high. Mathematical considerations show that such boats should be long, deep, and comparatively narrow, with great metacentric height. Moreover, the necessity for drawing the centre of gravity forward and the centre of lateral resistance aft leads to a deep, narrow forebody and a flat and broad aftbody, with large horizontal fins aft. The French submarine boats *Gustave Zédé*, *Morse* and others approximate to this type. Boats of less than six knots may be regarded as of low speed. In such boats great length is not necessary, and, on the whole, is objectionable as regards internal arrangements and weight of hull. In them it is not requisite to draw the centre of lateral resistance so far aft of the centre of gravity as in the high-speed boat, and they should, therefore, be of short length, small depth and great breadth. The metacentric height should be made as great as possible by a low centre of gravity, and large horizontal fins should be fitted aft. The Holland Torpedo Boat Company's first boat, the *Holland*, approaches this type, but differs in having greater depth and stability. For submarine boats to be able to travel below the surface for a distance of two, or perhaps three, miles is sufficient for most purposes.

Mr. H. G. Wells commences, in the current number of the *Fortnightly Review*, a series of speculative papers upon some changes of civilised life and conditions of living likely to occur in the new century. To construct a prehistoric animal from one or two fossil bones is a much easier task than the prediction of future developments from the point of view of the present; but Mr. Wells attempts to do this, and even if his prophetic visions do not materialise they will convince the conservative mind that there is some virtue in dissatisfaction at many of the methods of to-day. The subject of the first article is land locomotion in the twentieth century, and it scarcely requires a prophetic afflatus to know that the present systems will be largely superseded or modified. Horse traffic, with its cruelty and filth, while the animals exhaust and pollute the air, must give place to motor carriages in a few years. The railways will then develop in order to save themselves. There will be continuous trains, working perhaps upon a plan like that of the moving platform of the Paris Exhibition, or utilising the principle of the rotating platform outlined by Prof. Perry in these columns (vol. lxii. p. 412, 1900). Nothing is said about the possibilities of aëronautics, not because of any doubt as to its final practicability, but because "I do not think it at all probable that aëronautics will ever come into play as a serious modification of transport and communication." It is, of course, impossible to project ourselves into the future so as to say exactly what will or will not come to pass; for an estimate of future performances can only be made with the material now available, and it leaves out of account the completely novel discoveries which often revolutionise the whole conditions. Nevertheless, it is not unprofitable to meditate upon the promise of progress.

An address on weather knowledge and agriculture, delivered by Dr. Richard Börnstein at the Royal College of Agriculture of Berlin, in celebration of the Kaiser's birthday and of the two hundredth anniversary of the foundation of the kingdom of Prussia, has recently been issued in pamphlet form ("Wetterkunde und Landwirtschaft." Berlin: Paul Parey). Its concluding pages refer in most complimentary terms to the Kaiser's generous share in the promotion of scientific ballooning in Berlin, but the bulk of the address deals with the development of the German service of weather forecasts, and with suggestions for improving their accuracy and utility. Dr. Börnstein would have forecasts issued by local meteorological authorities, based on information supplied by telegraph from a central department and supplemented by knowledge of local climatology; he would also secure a more intelligent use of the information conveyed in the forecasts by the extension of instruction in the laws of atmospheric changes. It is not in Germany alone that such knowledge would be of advantage. There are occasions in which the weather in any one or more of the districts of the British Isles could be easily characterised by a single word of one or more syllables, but to go a little further into detail and make a forecast describing the weather of the ensuing twenty-four hours in ten words, and no more, requires, on the part of the recipient, some intelligent acquaintance at least with weather telegraphese. It appears that in Germany the local authorities have taken the matter up with the prospect, according to Dr. Börnstein, of securing a more effective weather service than any other country in Europe.

THE paper on combined trolley and conduit tramway systems, read by Mr. A. N. Connett at the last meeting of the Institution of Mechanical Engineers, is one of considerable interest and importance. Of the four systems of electric tramways only the conduit and the trolley can be considered to be commercially practicable, since the surface contact system, though not wanting many and distinguished advocates, can hardly be said to be properly out of the experimental stage, and the accumulator system is still waiting for a thoroughly satisfactory traction cell. The trolley and the conduit are both in wide use, especially in America and on the Continent, and there are many lines at work combining the two systems. The trolley is objected to in large towns on the ground of its ugliness, its potential danger and the disadvantage involved in using the track rails as a return conductor. The conduit, on the other hand, is too expensive for country or suburban lines where the cheaper trolley is admissible. We have, therefore, in the case of tramways running into crowded towns from the outlying districts, a need for a combined system; this involves a special construction of the car to enable a quick change to be made from the one system to the other at the point of junction, and it is the problem thus raised that Mr. Connett discusses. The paper also deals at some length with the relative merits of side and centre slots for the conduit system, and gives a comparative estimate of the costs of installing conduit and trolley systems respectively; it is to be noted that the conduit is about twice as expensive as the trolley.

ACCORDING to a recent report the expectations of the constructors of the great Chicago Drainage Canal, which was made for carrying away the sewage of the city, containing over a million inhabitants, have been realised. The idea of pouring the sewage of a large city, amounting to 50,000 cubic feet a minute, into an open channel and allowing it to flow away without any attempt at purification was both novel and startling. Now it appears, after eight months' working, none of the actions threatened by the towns bordering on the river below Chicago have been commenced, and it is reported by competent authorities that the water in the canal is free from objectionable features. In fact, the water-way is used largely by pleasure boats and the water taken by the manufactories situated on the banks. It has also been found, on investigation by the Government Commission, that so far no appreciable effect has been made in lowering the water in Lake Michigan, a consequence that excited at one time great fears on the part of the harbour authorities round the coast. The immunity from the objectionable conditions which prevail in the Manchester Ship Canal owing to sewage being discharged into it is due to the large volume of clean water that is always passing down the water-way from Lake Michigan, a stream 22 feet deep and running at the rate of a mile an hour being sufficient to neutralise the foul condition of the 50,000 cubic feet of sewage sent into it every minute.

THE embryos of the New Zealand tuatera lizard recently received in this country have afforded to Mr. H. S. Harrison opportunities for studying the early dental developments of that remarkable reptile, the results of which are published in the *Quarterly Journal of Microscopical Science* for March. The outcome of these studies is to show that Sphenodon (or, as it is often incorrectly called, Hatteria) in its early stages possesses numerous sharp-pointed teeth very similar to those of many ordinary lizards; and as these are of irregular size at a certain period, it is inferred that they represent several coalesced dental series. On the completion of this alternating series a period of repose occurs, after which a development of uniform teeth takes place. By a secondary formation of bone round their bases, these teeth acquire what may be called false sockets. Subsequently the sides of the jaws are invested with a highly calcified layer of bone, which, when the teeth become worn down and the sides of the jaws exposed, assists the edges of the latter in the assumption of dental functions in the adult.

TO those interested in domesticated animals, whether from the point of view of the breeder or of the study of variation under human influence, the spring number of *Bibby's Quarterly* should prove very welcome, as it contains an unusually large number of reproductions of photographs of prize and other cattle, sheep, horses, &c. As marking the changes introduced by breeders, such photographs are of very considerable importance, and their reproduction in a journal of this description renders them accessible to all. A feature of the present number is an article by Prof. J. C. Ewart on "Prepotency and Exclusive Inheritance." The numerous photogravures in this article illustrate the predominating influence of one or other parents on their offspring in many breeds of domesticated animals. In an article on Boer farm life, attention cannot fail to be arrested by the photogravures of an arum-field and of flocks of domesticated ostriches. Arums, it appears, are grown as food both for pigs and ostriches.

OPPORTUNITY to study the geology and physical geography of the basin of the Thames is afforded by the Saturday afternoon excursions of the London Geological Field Class, which commence on April 27. Visits have been arranged to places of geological interest both north and south of London, and the excursions provide exceptional facilities for examining some of the greater movements which the south-east of England has experienced. Particulars can be obtained from the honorary general secretary, Mr. R. H. Bentley, 43, Gloucester Road, Brownswood Park, N.

REFERRING to the periodic variations of glaciers, the remark was made in our issue of March 7 (p. 444) that, in the Swiss Alps "of fifty-seven glaciers observed in 1897, fifty were still decreasing, five were stationary and twelve were increasing." A correspondent points out that this would make sixty-seven glaciers observed, and the author informs us that the difference arose from a clerical error in copying the numbers from the original memoir. The number thirty-nine should be substituted for fifty, making the total number of glaciers observed to be fifty-six instead of fifty-seven.

THE first place in the March number of *La Geographie* is given to a review of Colonel Yates' book on Khurasan and Sistan, by Prof. Vambéry. M. Bonin continues his account of a journey from Pekin to Russian Turkestan by Mongolia, Koko-Nor, Lob-Nor and Dzoungaria. Papers on three expeditions in the French Congo region are contributed by MM. Jobit, Lœfler and Huot, and Mr. J. W. Hodge reviews recent ethnographic and archæological explorations in the United States.

WE have received a copy of the "Report of Progress of the Survey of Tides and Currents in Canadian Waters" for the year ending June 30, 1900, by Mr. W. Bell Dawson, engineer in charge. Considerable advance has been made in the preparation of tide-tables, and a pamphlet issued during the year on the currents in the Gulf of St. Lawrence has already been noticed in these columns. The observations secured during the year will, when worked up, afford an accurate knowledge of the times of the tides and of the turning of the tidal streams in the lower St. Lawrence. Many new observations of the tide-levels at different stations have also been obtained.

A METHOD for the preparation of amides from the corresponding aldehydes, which appears to be of general application, is described by Messrs. Pickard and Carter in the April number of the *Journal* of the Chemical Society. The aldehyde dissolved or suspended in water is shaken with a slight excess of ammonium persulphate and a certain quantity of lime, and after the reaction is over there is no difficulty in separating the amide in quantities amounting to 30 to 40 per cent. of the aldehyde taken. The method also lends itself to the preparation of alkyl-substituted amides, potassium persulphate being substituted for the ammonium salt and the alkylamine being present.

THE following species, among others, have been taken at Plymouth recently by the Marine Biological Association:—Mollusca: *Æolis aurantiaca, Gastrochaena modiolina.* Crustacea: *Achaeus Cranchii.* Polychæta: *Magelona papillicornis, Owenia fusiformis, Scalisetosus assimile.* Echinoderma: *Ophiocnida brachiata.* Hydrozoa: *Heterocordyle Conybeari, Syncoryne Loveni.* The pelagic fauna is increasing in richness and variety. The following have been taken:—Medusæ: *Amphicodon amphipleurus, Margelium octopunctatum.* Crustaceæ: *Podon intermedius;* large numbers of the nauplii and the *Cypris* stage of *Balanus.* Polychæta: post-larval stages of *Arenicola*, Trochospheres and later larvæ of Polynoids and Phyllodocids. Among the species breeding may be mentioned the following:—Crustacea: *Porcellana platycheles, Zantho rivulosus*; several species of *Portunus* and *Stenorhynchus phalangium.* Polychæta: *Myrianida pennigera, Polynoe scolopendrina.* Hydrozoa: *Hydrallmania falcata, Tubularia indivisa, Syncoryne Loveni, Garveia nutans, Diphasia rosacea, Sertularia argentea, Eudendrium ramosum.*

THE additions to the Zoological Society's Gardens during the past week include a Vulpine Phalanger (*Trichosurus vulpecula*) from Australia, presented by Mr. R. Kirkwood; a Patas Monkey (*Cercopithecus patas*) from West Africa, presented by Mr. H. E. Jung; a Common Coot (*Fulica atra*), European, presented by Mr. M. C. H. Hammond; two Picui Doves (*Columbula picui*) from South America, a Red-vented Bulbul (*Pycnonotus haemorrhous*) from India, presented by Mr. D. Seth-Smith; a Huanaco (*Lama huanacos*) from Bolivia, a Tawny Eagle (*Aquila naevioides*) from the Seychelles, a Nilotic Crocodile (*Crocodilus niloticus*) from Africa, four Menobranchs (*Necturus maculatus*) from North America, a West African Python (*Python sebae*) from West Africa, deposited; two Straw-necked Ibises (*Carphibis spinicollis*) from Australia, purchased; a Sykes Oriole (*Oriolus kundoo*), received in exchange.

OUR ASTRONOMICAL COLUMN.

RUTHERFURD MEASURES OF PLEIADES.—In the *Contributions from the Observatory of Columbia University*, No. 17, Mr. Harold Jacoby furnishes a revised discussion of the series of measures made by Rutherfurd of photographs of the Pleiades group dating from the years 1872 and 1874. The results of the first investigation were published in 1892, and are slightly modified in the present paper. Special reductions have been made to test the possibility of there being systematic errors arising from some form of optical distortion of the object-glass, and comparisons are given of heliometer and photographic measures. The final data are collected to form a catalogue of seventy-five stars in the cluster.

CATALOGUE OF SOUTHERN VARIABLE STARS.—Mr. Alexander W. Roberts has recently published in the *Astronomical Journal* (Nos. 491 492) a catalogue of the positions, magnitudes and elements of variable stars south of − 30° declination, reduced from observations made at the Lovedale Observatory with a 3¼-inch telescope during the years 1891-1899. In connection with the elements a new departure has been made by considering the epoch of a variable as the first maximum passage during 1900, all the stars being uniformly treated on this plan, except that Algol-variables are reckoned from the first *minimum* passage.

The author finds that the short-period variables have a mean variation of 1 magnitude, while the variation of the long-period class amounts to about 4·0 magnitudes. Reference is made to the possible connection of distinctive colours to the various types of variables.

The catalogue gives particulars of ninety-three variables, copious notes being included in explanation of individual stars.

ON A SOLAR CALORIMETER DEPENDING ON THE RATE OF GENERATION OF STEAM.

THIS instrument was shortly described in a note[1] which was communicated to the Royal Society of Edinburgh in July, 1882, and it has been fully described and figured in a paper[2] read before the Philosophical Society of Cambridge in December, 1900. In this paper the results obtained in Egypt in 1882 are detailed and discussed.

My object in designing the instrument and in taking it to Egypt was to find out for myself the amount of heat which can be actually collected from the sun's rays at or near the sea-level under favourable conditions. In such circumstances this amount must fall on land and sea alike, and it is the energy of this radiation which maintains the terrestrial economy.

The instrument measures the sun's heat in the same way as the calorific value of other fuels is commonly measured, namely, by the quantity of boiling water which a given quantity of it can transform into steam of the same temperature in a given time. The quantity of the sun's radiation used is measured by the capacity of the reflector which collects it. The reflector concentrates it on the boiler, which is a silver tube with blackened surface, placed in the focus of the reflector. Some radiation is necessarily lost at the reflector and some at the surface of the boiler, because perfect reflectors and perfect absorbers do not exist; but, when the distillation has been started and is in full running, the whole of the heat which penetrates the boiler is used in transforming water into steam, which is retransformed into water in the condenser and measured in the receiver. A portion of the heat of condensation is utilised in raising the feed water to the boiling temperature before entering the boiler.

The details of construction and the dimensions are fully set forth in the paper printed in the *Proceedings* of the Cambridge Philosophical Society. It will be sufficient here to give a brief summary. Fig. 1 shows a general view of the calorimeter mounted equatorially on a tripod. Fig. 2 shows the calorimeter in section. The sun's rays are collected by the reflector $B_1 B_2 B_3 B_4$, which consists of three conical mirrors, $B_1 B_4$, $B_2 B_3$ and $B_3 B_4$, so constructed that rays of light, parallel to the axis of the instrument O P, falling upon these mirrors are all reflected upon the length A B of the axis. A B is the *focal line* of the reflector. The mirrors are carried by arms, as shown, which are attached to the central tube C K. This tube, which is twelve inches long and has a diameter of two inches, is the condenser. It is connected by an india-rubber tube with the glass funnel Z, through which it is filled and by means of which the height of the water in the upper and narrower tube C A can be regulated. The portion A B of this tube is the boiler. It is of silver, blackened outside, and has a circumference of 37 millimetres. When the instrument is pointed to the sun all the rays which strike the mirrors are reflected upon this surface, which has an area of 18·8 square centimetres. The effective collecting area of the reflector is 904 square centimetres, so that the rays are concentrated 48 fold. The glass funnel Z is set so that the level of the water inside the calorimeter stands somewhere between E and F. F G H is a glass tube or dome which performs the functions of a water-gauge, a steam space and a means of watching the distilling operation with a view to being perfectly assured that there is no priming. The tube G L in the

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[1] *Proceedings* of the Royal Society of Edinburgh, 1882, xi. 827.

[2] On a solar calorimeter used in Egypt at the total solar eclipse in 1882. By J. Y. Buchanan, F.R.S. *Proceedings* of the Cambridge Philosophical Society (1900), xi. pp. 37, 74.